SECRET
(When Filled In)

SPEED LETTER	REPLY REQUESTED	DATE 12 JUNE 1967
	X YES ☐ NO	LETTER NO.

TO : SECURITY STAFF/O.L.
ATTN:

FROM: [redacted] 25X
TDS/NPIC

1. THE ATTACHED REQUEST FROM [redacted] INDICATES THEIR DESIRE TO PRESENT THE RESULTS OF ~~A~~ THREE DEVELOPMENTS SPONSORED BY THIS OFFICE. 25X

2. ALTHOUGH THE WORK PERFORMED UNDER THE THREE CONTRACTS WAS NOT OF A CLASSIFIED NATURE; NOR IS THE INFORMATION INCLUDED FOR PRESENTATION CLASSIFIED, THE ASSOCIATION OF THE AGENCY SPONSORSHIP WAS CLASSIFIED IN ALL CASES.

3. SINCE THIS OFFICE HAS NO OBJECTION TO A RELEASE OF THE TECHNICAL INFORMATION, THIS REQUEST IS FORWARDED FOR YOUR CONSIDERATION AND DECISION REGARDING ANY OTHER SECURITY MATTER.

[redacted] 25X

SIGNATURE

OK P/ REPLY DATE 14 June 67

To: Contracting Officer, NPIC, [redacted] 25X

OL/SS interposes no objection to release of information if Contractor makes formal request to C.O.

[redacted] 25X

OL/SS

NGA Review Complete

SIGNATURE

RESPONDER'S FILE

FORM 5-61 1831

SECRET

[redacted]

June 9, 1967

Attention: Paul L

Gentlemen:

25X1 [redacted] is interested in presenting three papers at the October meeting of the Optical Society of America. Since each of the proposed papers is relative to contracts we have completed for you, your approval to present these papers is requested.

The papers are:

"A Prism Variable Anamorphic Eyepiece System for a Microscope" to be presented by

25X1 [redacted]

"A Cylinder Lens Zoom System for Vairable Anamorphism" to be presented by

25X1 [redacted]

"Application of the Four Bar Linkage to an Anamorphic Zoom System" to be presented

25X1 [redacted]

The technique used by the Optical Society of America is to publish a lengthy abstract prior to the presentation. The actual presentation is more of a discussion of the problem as opposed to a formal reading of the paper. The attached is the extent of our intended publication of the proposed papers.

To allow us to submit the papers for inclusion in the Optical Society of America Fall Meeting your decision is requested on or before July 6, 1967.

Very truly yours,

[redacted] 25X1

Head, Photogrammetric
Contracts Section

25X1 [redacted]:mm
Encs.

25X1 cc: [redacted]

[redacted]

June 9, 1967

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Very truly yours,

[redacted] 25X1

Head, Photogrammetric
Contracts Section

25X1 [redacted]

Encs.

25X1 cc: [redacted]

A Prism Variable Anamorphic Eyepiece System for a Microscope

25X1

A variable anamorphic capability had to be provided for use in the Zoom "70" Stereoscope. The system was to be compact, require essentially no microscope modification and be easily and quickly interchangeable with standard eyepieces. Optically the system was to provide 1x to 2.2x continuously variable anamorphism in any desired direction with an errect image and no loss of field. Diffraction limited image quality had to be maintained. It was desirable that the system be insensitive to normal mechanical tolerances and minor alignment errors.

After some study a prism anamorphic system was chosen because it seemed potentially able to solve the machanical requirements of the system. It could be designed somewhat shorter and much smaller in diameter than comparable cylindrical lens anamorphic zooms and provided insensitivity to minor manufacturing errors. Of major importance, anamorphic and non-anamorphic image surfaces are always coplaner regardless of component tolerances and their relative position.

The optical system of the instrument consists of an identical pair of field and collimating lenses with the prism anamorphic components placed between them. A Pechan prism is placed between each collimator and field lens to perform a unique combination of functions described below. The system must be entirely above the erecting prism cluster of the Zoom "70" and be contained within half of the 55mm minimum I.P.D. of the instrument.

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The optical design of spherical components of the system followed entirely standard procedures. The combination of two field and collimating lenses provided a symmetric one to one relay system with collimated light between them. The Pechan prisms were placed in the system between the field and collimating lenses at 90^{o} to one another to fold the optical path and to erect the image. By this method the focal lengths of the collimator and field lenses may be increased to reduce both field angles and field curvature in the system. The increase of axial speed in the collimated light space reserved for the zoom system is of little consequence to prism zoom design. A slight deviation from symmetry was required (for mechanical reasons) in the Pechan prism sizes. This and aberation contributed by the long glass paths in the prisms were compensated by the design of the collimator doublets and the choice of different glasses for the pechans. Nominally the pupil of the system is imaged between the two collimator lenses in the middle of the prism zoom system. A standard eyepiece is used to view the final image.

The design of the prism zoom system is the most unique part of the system. In this design it was necessary to obtain unusually good correction of aberrations over a substantial field angle for this type system. In addition pupil parameters had to be controlled to prevent eyepiece vignetting and maintain eye relief with a given microscope. The design is further complicated by the presence of the non-anamorphosed plane of the image which eventually acts as a standard of comparison and the non-anamorphosed exit pupil which must be in coincidence with the anamorphosed pupil. These requirements and the absolute premium of available space make it possible to obtain only a rough prototype using the procedures normally applied to complete such a design. Four achromatic prisms were used in the design to provide the required 2.2x to 1x afocal zoom range with adequate correction. Only anamorphic magnifications greater than unity were permitted because the field of view is determined by the microscope and must always fill the field stop of the eyepiece. Since prism zoom systems usually work around unit power due to symmetry, this is equivalent in difficulty to requiring a 4.84 to 1 zoom range. In fact, except for physical stops, the final system will perform at magnifications of from .45x to 2.2x with no loss in image quality. The four prisms also permitted a straight through system and adequate freedom to control lateral and longitudinal pupil shifts.

After the system was roughed out a raytrace program was developed to trace entire tangential and sagittal fans from any object point through the entire system. This permitted detailed examination of exact chromatic aberrations and distortion study of exit pupil characteristics, and determination of apertures of the prism system itself. Although the prism system in collimated light does not contribute any other aberrations of its own the program was also necessary to ascertain the effects of the prism systems variable magnification on the aberrations already present in the system. Then by redesign of the collimating system they could be altered to provide suitable final values. Graphical methods were also used extensively to correct the pupil characteristics of the system, establish required thicknesses, and determine prism pivot points to obtain the smallest possible system.

Distortion correction required the prisms to be grouped into pairs, each prism of a pair canceling the distortion of the other as was expected. It was found however, that with the predetermined field angles the necessary amount of color correction throughout the zoom range could not be obtained with the usual type of color correction. Using the programs it was possible to obtain adequate correction by altering the individual color correction of each pair of achromatic prisms. Both achromatic prisms of a pair were maintained identical but the pairs were given a dynamic balance throughout the zoom range. By this method the required similarity between prism pairs to obtain pupil control was still obtainable.

Several prototypes of the final system have been built and have performed in every respect according to predictions. Image quality with the equiped microscope has proved to be equivalent to that of the unequipped instrument. The device has proven insensative to the moderate tolerances imposed on its manufacture and extremely simple to align and adjust. The only necessary adjustment have been to establish the ends of the zoom range. Lateral pupil shift during anamorphic zooming has been reduced to immeasurable values and longitudinal pupil disparity is never greater than 0.5mm. The entire prism zoom system is less than 20mm long and 8mm in diameter. The entire package increases the microscope less than 4 inches, weighs about a pound and interchanges with standard eyepieces in seconds.

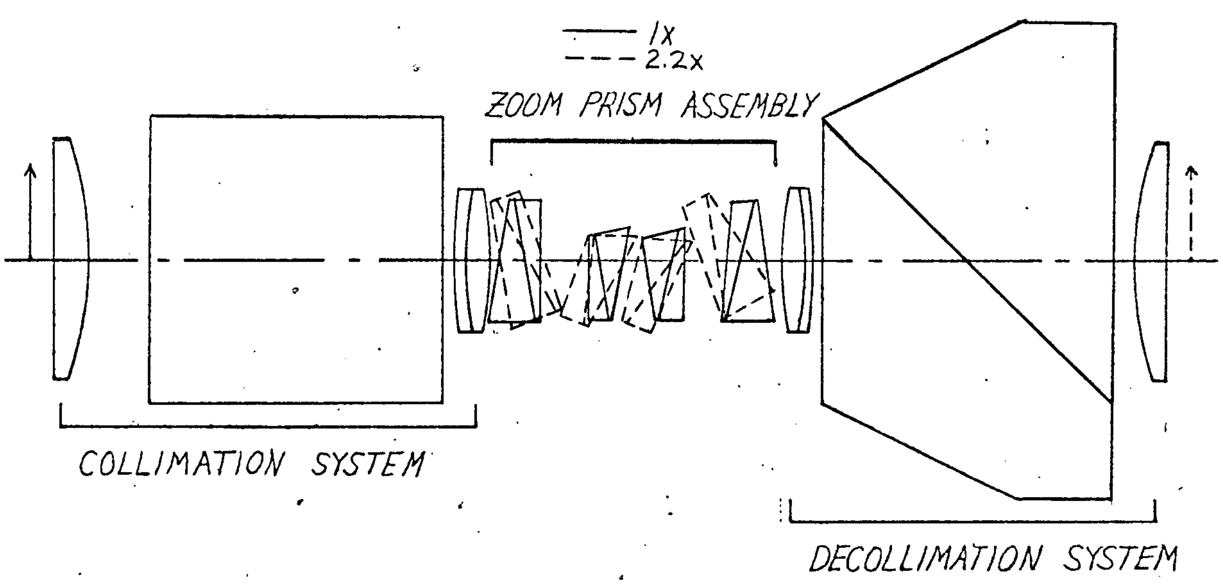


FIGURE 1. ZOOM ANAMORPHIC EYEPIECE

A Cylinder Lens Zoom System for Variable Anamorphism

25X1 [redacted]

A variable anamorphic system has the property that it changes the magnification of an image in one direction only. Such a system is capable of changing a square to a rectangle or parallelogram, i.e. holding one dimension constant while magnifying another continuously within the range of the zoom system.

The first variable anamorphic system designed at [redacted] was intended to be an eyepiece for the [redacted] Zoom 70 stereoscope. It was in fact called the Variable Anamorphic Eyepiece though in reality it was a unit power relay system containing an afocal anamorphic zoom system.

25X1

25X1

The requirements for this system were as follows:

1. The anamorphic magnification range was to be from 1:1 to 3:1. It was permitted to stretch an image but not compress it.
2. The system was to degrade the image quality of the Zoom 70 as little as possible.
3. The direction of anamorphic magnification was to be rotatable 360^{o} and a suitable lock must be provided.
4. The system was to be sufficiently compact that it could be used in lieu of the eyepieces for the Zoom 70. Specifically no more than five inches could be added to the length of the eyepiece tubes of the Zoom 70.
5. The diameter of the assembly was to be small enough so that a person with an interpupilary distance of fifty-five millimeters could use it.
6. Two such devices were to be designed and fabricated in two months from

the receipt of the contract. To meet the above schedule it was absolutely essential that the basic design be completed in two weeks so that material could be ordered and mechanical design could begin. All optical manufacturing drawings complete with test glass radii, tolerances and other data had to be complete in four weeks.

There was little time for seeking an elegant first order solution for the system, consequently the design approach taken was that which would be the simplest to design and the most likely to succeed.

It appeared that any variable anamorphic system with a magnification range of 1 to 3x would have to consist of cylinder lenses. The aberrations of cylinder lens systems working at finite conjugates are very complex. There are, for example, sixteen coefficients which describe the third order aberrations for cylinder systems corresponding to the five Siedel aberrations for rotationally symmetrical systems. Ten of the sixteen are automatically corrected for afocal cylinder lens systems. The obvious solution was the afocal cylinder lens zoom system working in the collimated light between the two lenses of a unit power collimating relay. The anamorphic image of this relay would be viewed by means of a conventional eyepiece.

The cylinder lens zoom system is nothing more than a stack of plano plates in the plane of the cylinder axes. It has no aberration in this plane. Consequently the unit power relay must be corrected in itself. As a result of this fact the anamorphic zoom system must also be corrected in itself.

It soon became apparent that two other criteria must be satisfied if the system were to perform satisfactorily. First the zoom system could not depart from the afocal condition as much as a system of spheres because such departure would result in axial astigmatism rather than just a slight shift in focus.

Also astigmatism of the pupil must be well enough corrected throughout the zoom range so that all parts of the field of view could be seen from a single eyepoint.

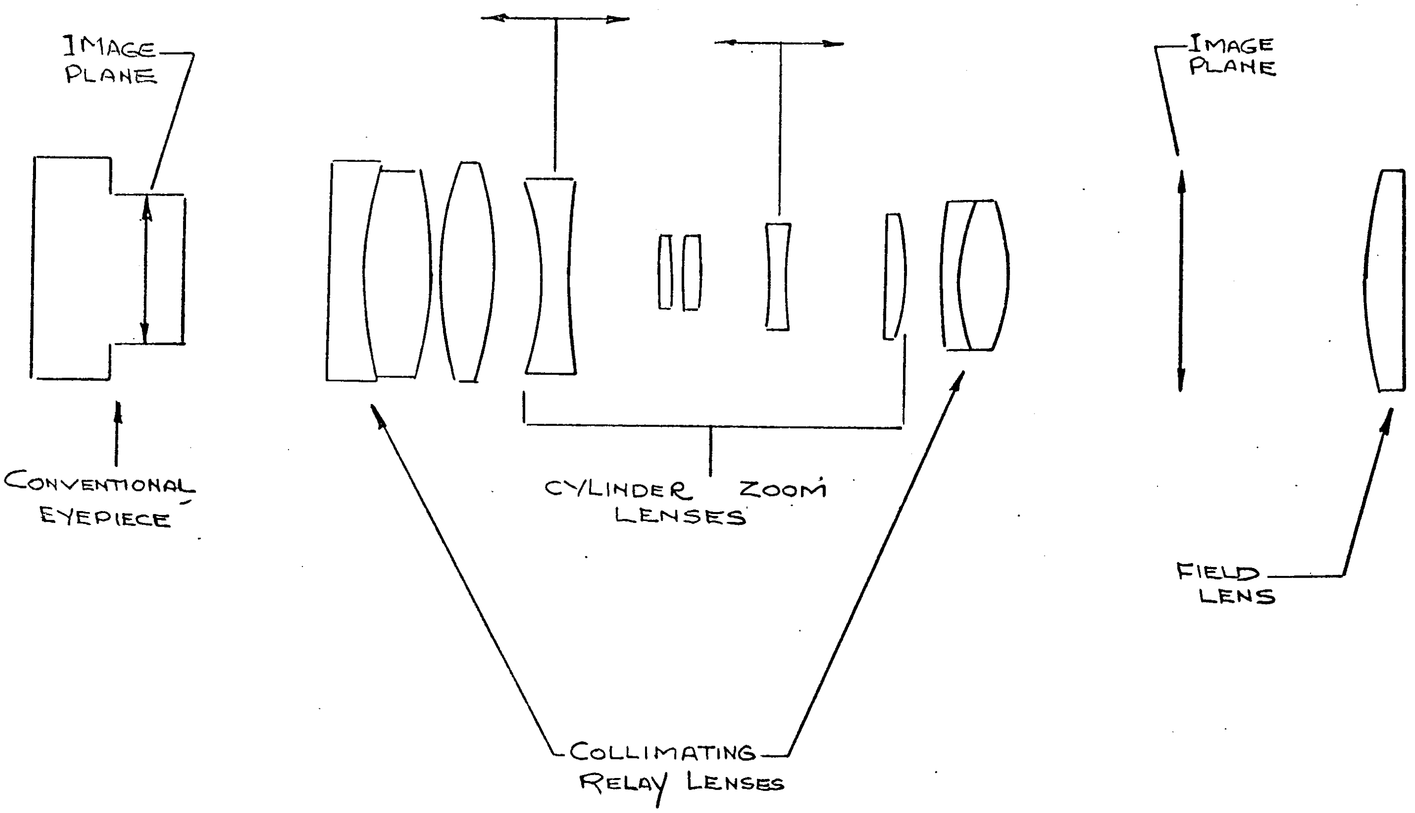
The designer had at his disposal computer programs capable of anlysing optical systems containing spherical and aspherical surfaces including torics and cylinders. Automatic correction capability also existed for systems of spherical surfaces. The afocal cylinder zoom system, while not exactly the same as a spherical zoom system, is close enough so that spherical lens design technique could be used to design it.

An afocal optically compensated zoom lens attachment for a motion picture camera was selected as the prototype for the zoom system. One motion was made slightly non-linear to elminate the focal shift inherent in all optically compensated zoom systems.

As few lenses as possible were used in this system to prevent loss of motion in the moving lenses due to lens thickness. Any such loss of motion would tend to reduce the zoom range. The individual components are not even achromatic doublets although color correction in the zoom system as a whole is quite acceptable. The design of the unit power relay was routine.

The system was constructed and performed satisfactorily. Out of practical experience with its capabilities and limitations came specifications for improved instrumentation which has been subsequently developed.

VARIABLE ANAMORPHIC EYEPIECE



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APPLICATION OF THE FOUR BAR LINKAGE TO AN ANAMORPHIC ZOOM SYSTEM

25X1

Recently a requirement arose for a compact variable anamorphic viewing system. The optical system consisted basically of a collimating lens, a four moving prism variable anamorphic system, and a decollimating lens. It was necessary to rotate each of the prisms through angles of approximately thirty degrees with the angular relationship between prisms held to less than five arc minutes. Previous designs of similar systems had used cam drives to obtain the prism rotation. In this system mechnical limitations were such that there was no space for a cam, and some other means of achieving non-linear motions had to be found.

The angular motions required are shown in Figure 1. From this it can be seen that the first and third, and second and fourth prisms had equal and opposite motions. This suggested an inverse linear linkage provided a means of imparting the necessary motions to prisms one and two could be found. It was decided to investigate the possibility of using a four bar linkage to achieve all motions.

The initial evaluation of this approach was done graphically. The total system was less than an inch long so that a sketch at a 25X scale was reasonable. Alternatively this scale was sufficiently large that with careful work a reasonably accurate system could be developed. By trial and error, start angles and linkage points for each prism were selected using prism three as the driving prism. This process took about two days. From this design a cardboard mock up was made for cruder evaluation of any potential problem areas. On the basis of this evaluation it was determined that the four bar linkage could be made to provide the desired motions.

The initial accurate mechanical design was also done using graphical methods . The central two prisms were laid out at 100X scale. Using this scale it was possible to lay out the linkage to an accuracy of one minute of arc prism rotation. It was also possible to design the linkage connecting the first and second prism this way. By the way the system was laid out the first prism drove the fourth prism. This link was almost an inch long and at 100X scale the drawing became too large to be manageable. A close approximation was obtained from a 50X layout, but this was not considered accurate enough.

Consequently a program was written for analysis of the linkage. This analysis confirmed that the final linkage was not satisfactory. It also showed that improvements could be made in the other links, although they were within tolerance. Small changes were made in the parameters and the effects on the motions determined. From these data new values were selected and by trial and error a suitable solution was determined. The program could, of course, have been automated to refine the design. However, the trial and error process was so rapid that it was not considered worthwhile to take the time to do the necessary programming. Figure 2 shows the final mechanical configuration of the linkage.

The final design gave motions deviating from the required values by less than two minutes of arc. Analysis of manufacturing problems has shown that the system will be much easier and more economical to construct than the more conventional cam type drives. Further, the space requirements for the four bar linkage are much less than for the cam drive. Hence it has been possible to construct the whole prism anamorphic assembly to fit inside a cylinder approximately five eights of an inch in diameter. Without this development it is doubtful that the severe mechanical restrictions of this pr[illegible]

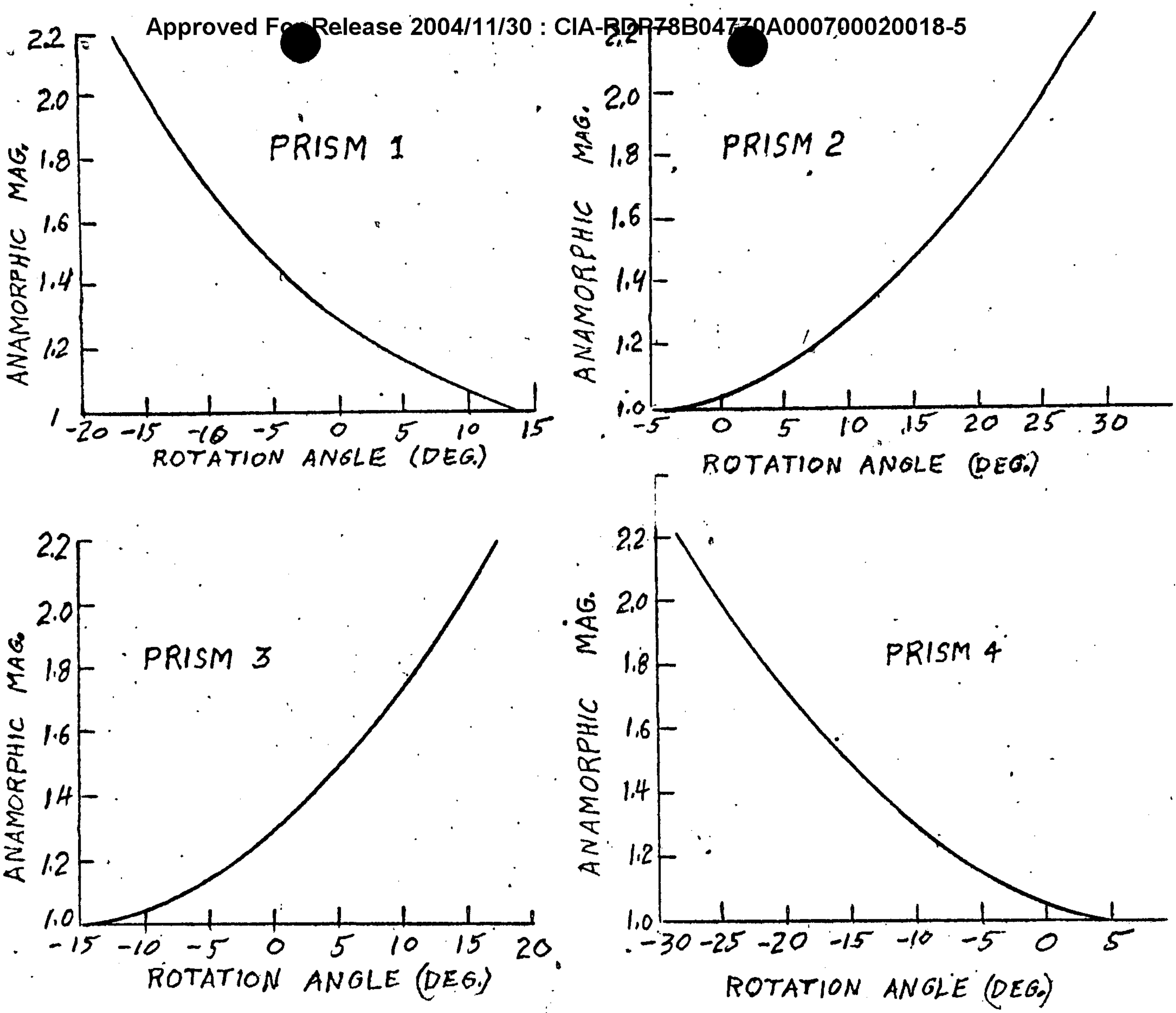
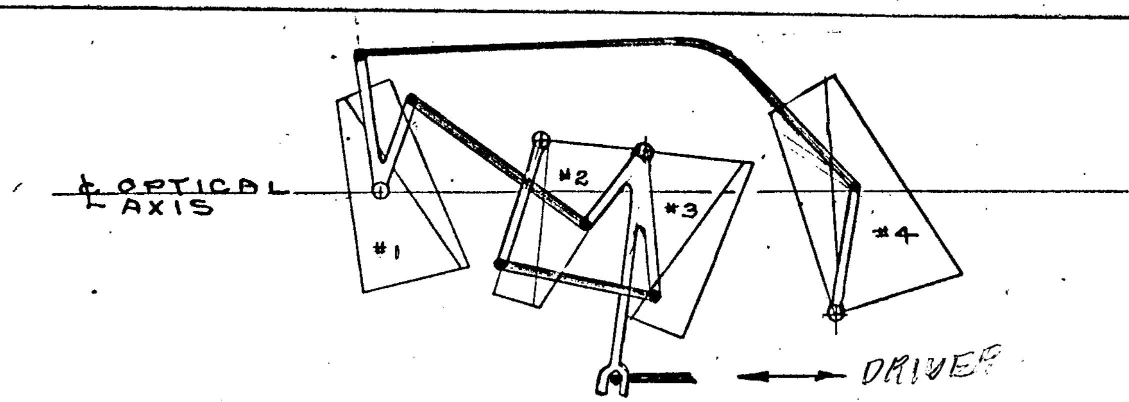


FIGURE 1



⊕ DENOTES POINTS OF PRISM ROTATION

• DENOTES PIVOT POINTS OF LINKAGE

FIG. 2 CONFIGURATION OF

FILE
#02091

PICTURES

25X1

Mac
3423

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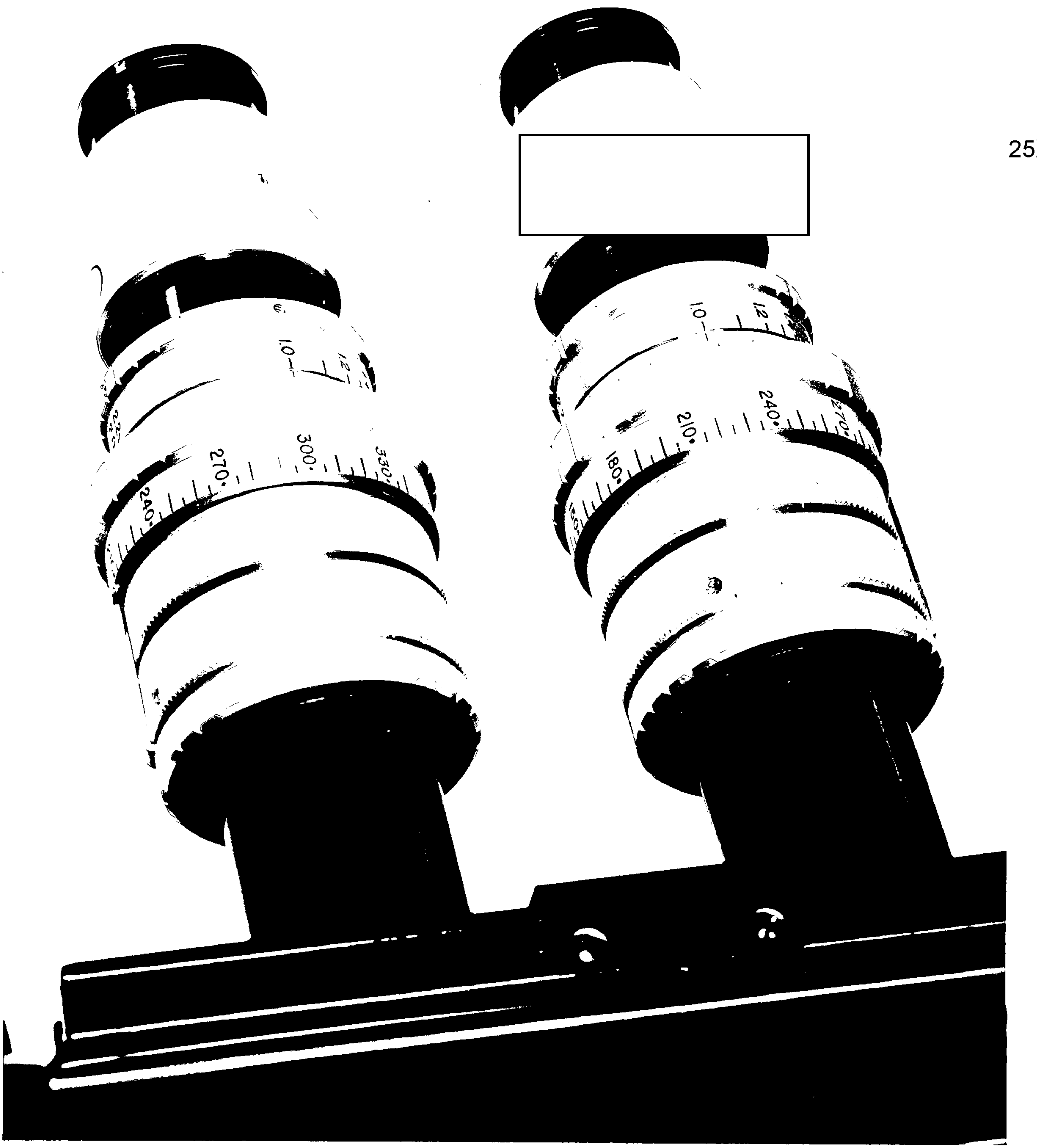
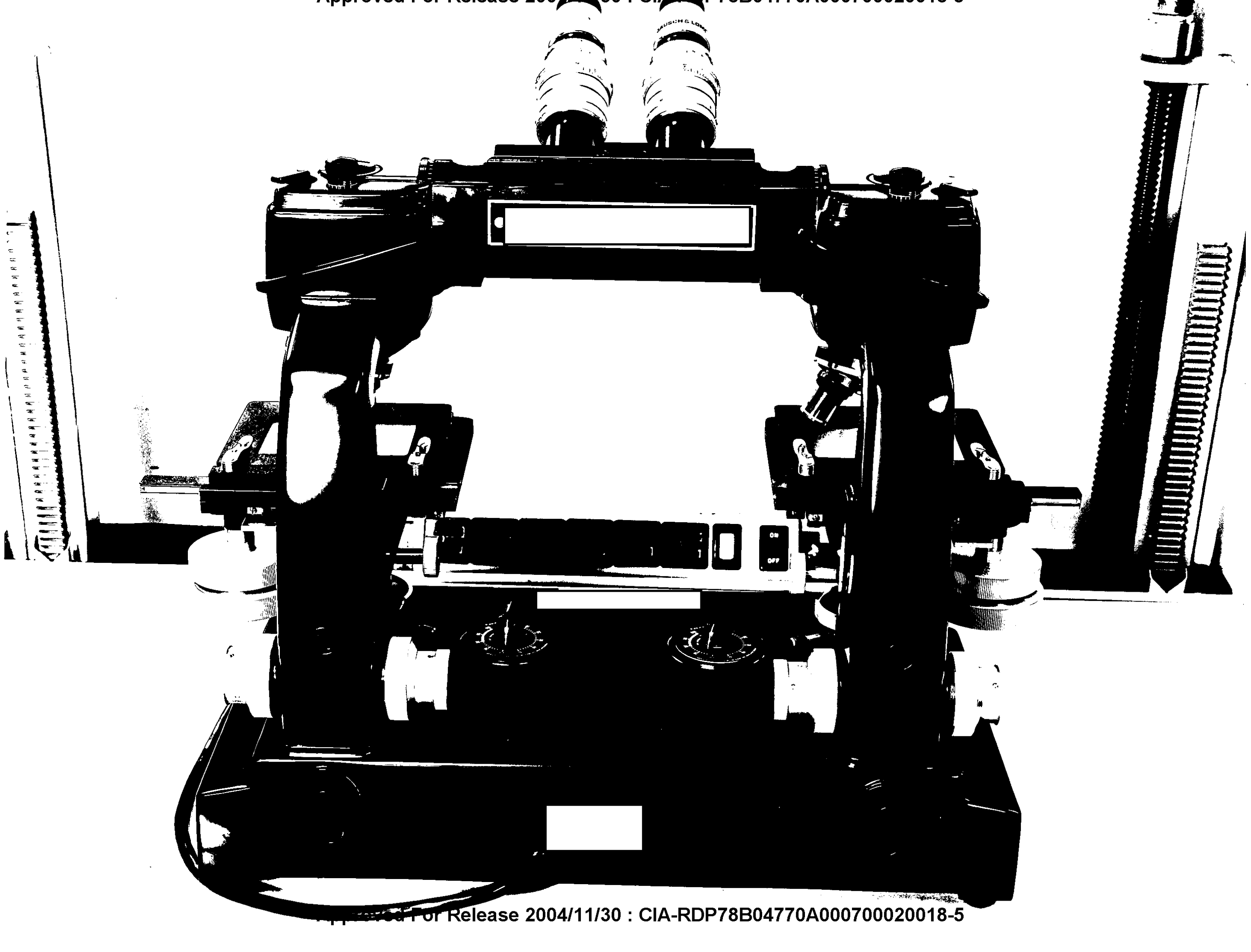


25X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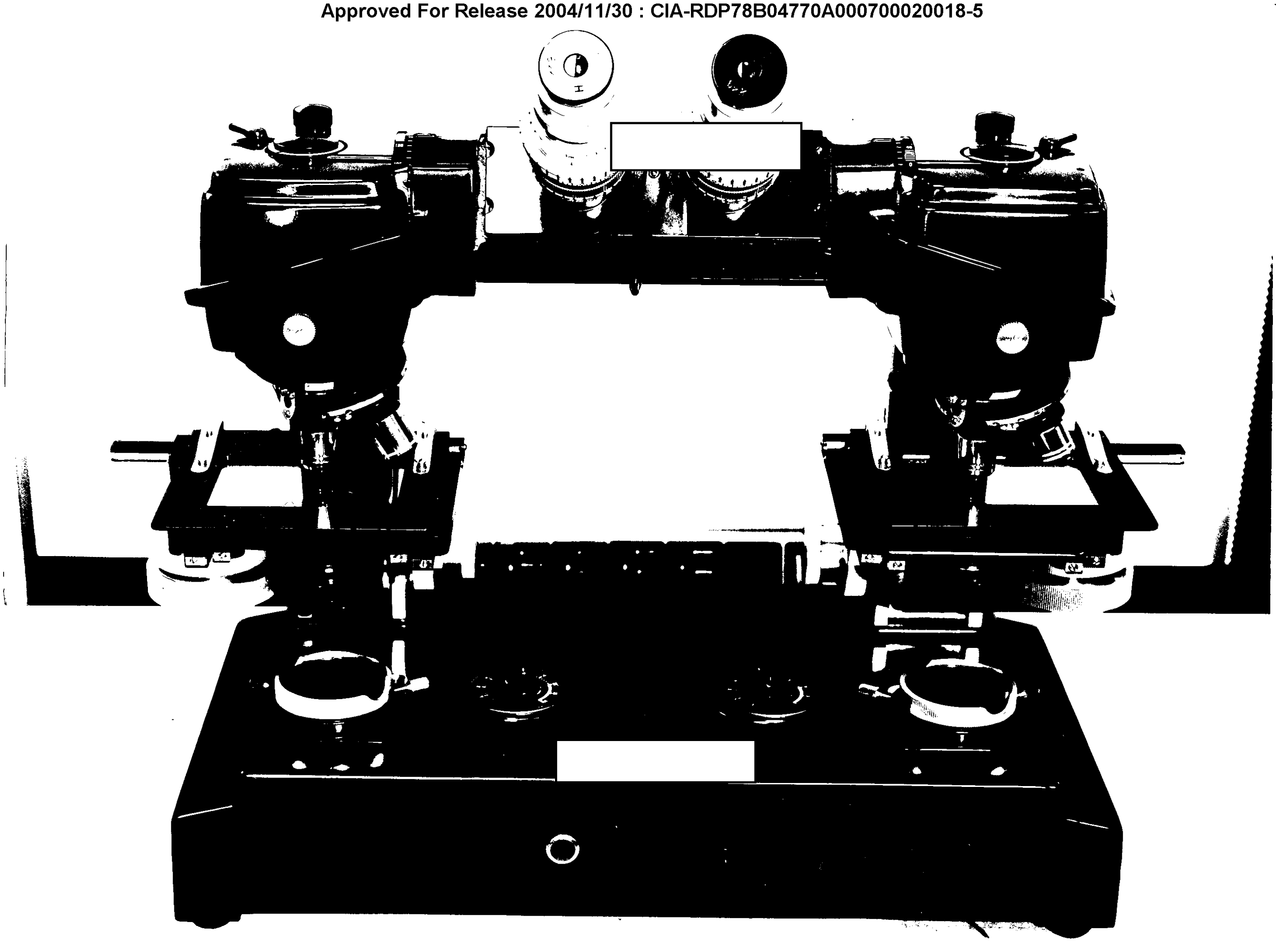
OFF



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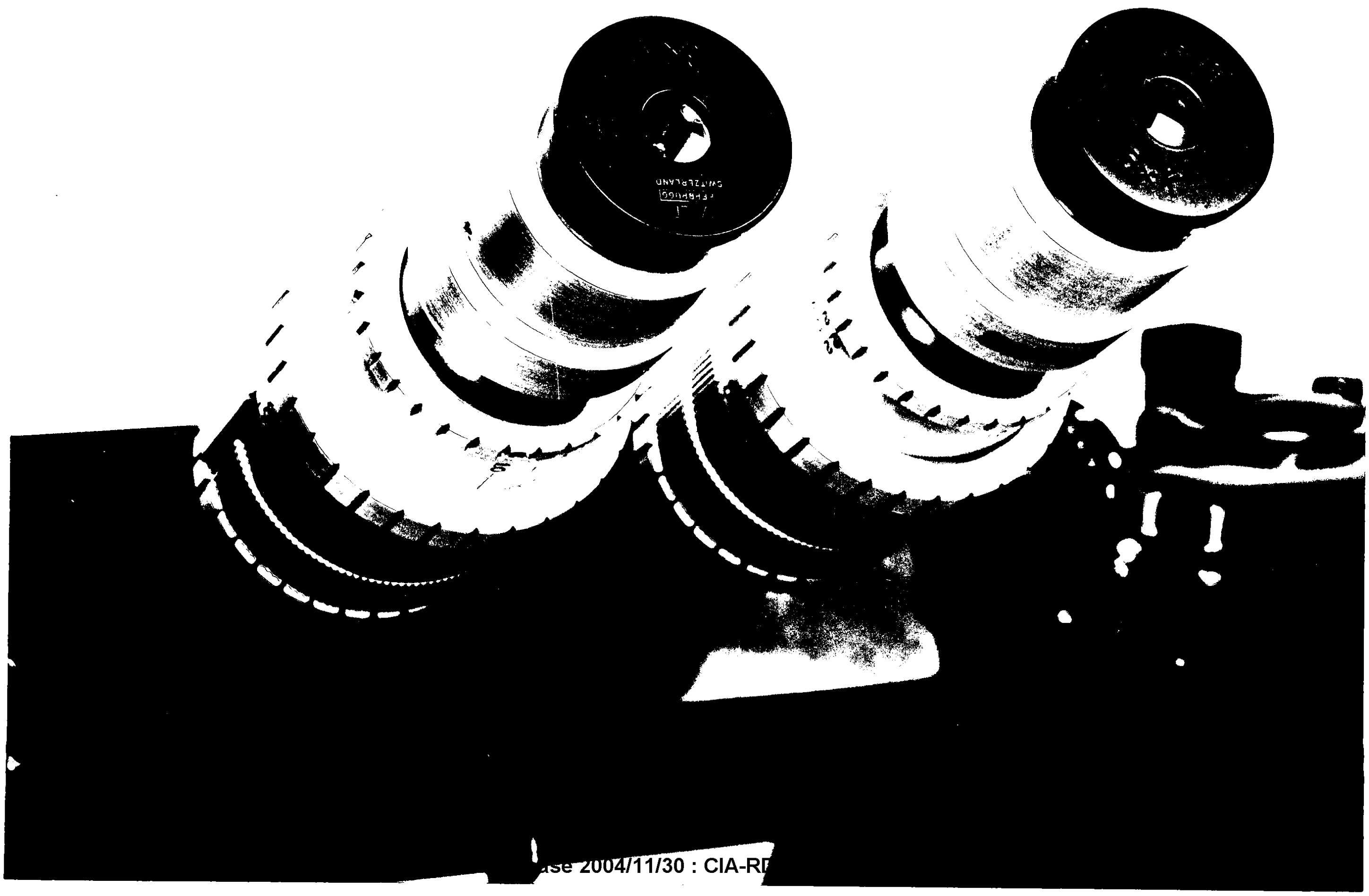

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PROPOSED PROGRAM

FOR

DESIGN AND FABRICATION

OF AN ANAMORPHIC SYSTEM

FOR HIGH POWER STEREOVIEWER

160/66

Copy 1

TRANSMITTAL SLIP | DATE

TO:

ROOM NO. | BUILDING

REMARKS:

[redacted]

1. COST QUOTE [redacted] ? ea DOES THIS MEAN PR.

2. ONE HAND OPERATION?

3. PHASED CONTRACT?

4. DRAWINGS?

1. MOUNT FOR FAIRCHILD

FROM:

ROOM NO. | BUILDING | EXTENSION

TRANSMITTAL SLIP | DATE

TO:

ROOM NO. | BUILDING

REMARKS:

PAGE 1 - 360°
ABOUT 1" EXTENTION

78

FROM:

ROOM NO. | BUILDING | EXTENSION

FORM NO. 241 1 FEB 55 REPLACES FORM 36-8 WHICH MAY BE USED. ☆ GPO : 1957—O—439445 (47)

[redacted]

CONFIDENTIAL

September 28, 1966

25X1 [redacted]
Post Office Box 6788
Fort Davis Station
Washington, D. C. 20020

Attention: Bill K.
Subject: Request for Proposal No. RD-2-67
Project No. 02097

Gentlemen:

Enclosed are two (2) copies of our technical proposal for the subject request. Also enclosed are two (2) copies of our cost quotation prepared on Form DD-633-4. The total cost on this form is to design and build one pair of eyepieces. This is a CPFF quotation.

Budgetary quotes for larger quantities are as follows:

5 pair -- [redacted] 25X1

10 pair --

20 pair --

30 pair --

Please refer any questions concerning our technical proposal and cost quotation either to the writer's attention or [redacted] 25X1

Very truly yours,

25X1 [redacted] mm
Encs.

Contract Administrator
Photogrammetric Contracts Section

Group 1
Excluded from automatic downgrading and declassification

CONFIDENTIAL

25X1

15. OVERHEAD RATE AND GENERAL AND ADMINISTRATIVE RATE INFORMATION

A. GOVERNMENT AUDIT PERFORMED	DATE OF AUDIT	ACCOUNTING PERIOD COVERED
[X] YES [ ] NO [ ] PENDING	August, 1966	1965

25X1

25X1

B. NAME AND ADDRESS OF GOVERNMENT AGENCY MAKING AUDIT	C. DO YOUR CONTRACTS PROVIDE NEGOTIATED OVERHEAD RATES (ASPR 3-704)? *(If yes, name Agency negotiating rates)*
Defense Contract Audit Agency, [redacted]	Yes - Defense Contract Audit Agency

D. *(If no Government rates have been established furnish the following information)*

DEPARTMENT OR COST CENTER	RATE	BASE	TOTAL INDIRECT EXPENSE POOL	BASE FOR TOTAL

16. EXHIBIT A - SUBCONTRACT INFORMATION *(If more space needed, use blank sheets, identifying item number)*

NAME AND ADDRESS OF SUBCONTRACTOR(S)	SUBCONTRACTED WORK	SUBCONTRACT TYPE	SUBCONTRACT AMOUNT

17. EXHIBIT B - OTHER DIRECT COSTS *(Specify. If more space needed, use blank sheets, identifying item number)*

CERTIFICATE

The labor rates and overhead costs are current and other estimated costs have been determined by generally accepted accounting principles. Bidder represents: (a) that he [ ] has, [X] has not, employed or retained any company or person (other than a full-time bona fide employee working solely for the bidder) to solicit or secure his contract, and (b) that he [ ] has, [X] has not, paid or agreed to pay to any company or person (other than a full-time bona fide employee working solely for the bidder) any fee, commission, percentage or brokerage fee, contingent upon or resulting from the award of this contract, and agrees to furnish information relating to (a) and (b) above, as requested by Contracting Officer. *(For interpretation of the representation, including the term 'bona fide employee,' see (Code of Federal Regulations, Title 44, Part 150.)*

Number of contractor employees [X] Over 500 [ ] Under 500 25X1

25X1 State incorporated in [redacted]

25X1

DATE	S[redacted]THORIZED REPRESENTATIVE OF CONTRACTOR [redacted]
9/28/66	Head, Photogrammetric Contracts Section

25X1

[redacted]

CONFIDENTIAL

September 28, 1966

25X1 [redacted]
Post Office Box 8031
Southwest Station
Washington, D. C. 20024

Subject: Request for Proposal No. RD-2-67
Project No. 02097

Gentlemen:

25X1 [redacted] is pleased to submit three (3) copies of our technical proposal for the subject request.

Any questions concerning this proposal should be directed to either the writer or [redacted]. 25X1

Very truly yours,

[redacted] 25X1

Contract Administrator
Photogrammetric Contracts Section

25X1 [redacted]mm
Encs.

CONFIDENTIAL

Group 1
Excluded from automatic
downgrading and
declassification

25X1

Proposed Program For
Design and Fabrication of Anamorphic System
For High Power Stereoviewer

September 1966

Prepared By

25X1

Approved For Release 2004/11/30 : CIA-RDP78B04770A000700020018-5

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	4.2 Work Statement	6
5.0	CAPABILITY	6

LIST OF ILLUSTRATIONS

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		Following Page
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4-2	Organization of Research and Development	5
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1.0 INTRODUCTION

25X1 [redacted] proposes a two phase program for the design and fabrication of an Anamorphic System for the High Power Stereo Viewer. The program will consist of a Phase I Design Study effort to design a system meeting the stated requirements. Phase II will be the fabrication of the system designed under Phase I.

25X1 To this effort [redacted] will bring the experience gained in the design and development of two anamorphic systems to fit the Zoom 70 stereoscope. The first unit designed was excessively long, too heavy, and gave an inverted image. The second, currently being manufactured, will not have these objectionable features. Previous to the design of the second system an extensive study of methods of achieving variable anamorphism were investigated. The knowledge gained from that study will be applied to the present effort.

2.0 TECHNICAL DISCUSSION

The requirements for the anamorphic system are that it have a range of 2.2 to 1, shall maintain 95% of the existing field, anamorphism shall be rotatable through ? 350^{o}, the eyepoint shall not be increased more than three inches, and the system shall not degrade the performance of the High Power Stereoviewer when used with 25X1 [redacted] objectives and compensating eyepieces.

The last requirement decrees the type of system that must be considered. The objectives and compensating eyepieces are proprietary products of the [redacted] while the High Power Stereoviewer is a proprietary product of 25X1 25X1 [redacted] Thus it is impossible for any one organization to know the parameters of the system as it is used. Hence detailed optical design analysis of the system is impossible, and modification of the design cannot be done with assurance of success. Therefore, it follows that the anamorphic system must be a diffraction limited attachment that makes use of all existing components. Such an attachment will add no aberrations of its own to the system, and, by proper design will assure that its use does not substantially alter the path of light rays through the existing components of the system.

On the basis of our past experience this system should consist of a collimator, an anamorphic system and an objective lens. Repeated efforts to design an anamorphic system which operated in non-collimated light have resulted in failure. While the desired anamorphism and image quality could be attained there always existed a serious problem in forming the anamorphosed and un-anamorphosed images in a common plane. By making the anamorphic system afocal and placing it in a collimated path this problem is easily resolved.

Thus the problem is reduced to determining how to fit an attachment into the system that will provide a collimated path for a variable anamorphic system, that will be diffraction limited, easily attached, and will not raise the eyepoint more than three inches. The proposed technique for accomplishing this is discussed in the following section.

3.0 PROPOSED SOLUTION

In previous attempts to design variable anamorphic attachments it has been necessary to use a positive collimating lens to provide the path of collimated light for the variable anamorphic system. Making a reasonable allowance of two inches for the collimator, an inch or so for the variable anamorphic system, and another two inches for the final objective lens the minimum increase in eyepoint height is about five inches. Further the image is inverted, and this is unacceptable. A recent effort to design such a system makes use of Pechan prisms to erect the image, and minimize the eye height extension. Even doing this, however, it has not been able to decrease the eyepoint extension much below four inches. And this is unacceptable in the present case where eyepoint increase is restricted to three inches or less. Thus a new approach must be considered.

The eyepiece mount of the High Power Stereoviewer is a simple tube that screws on the instrument, and is locked in place with a simple set screw. Removal of this tube (but releasing the set screw and unscrewing the tube) discloses the final relay lens an inch or so inside the main tube to which the eyepiece tube is assembled. This lens is the final one of the chain that transfers the image from the Dynazoom portion of the system to the High Power Stereoviewer eyepiece focal plane. It will be possible to place a negative collimating lens near this lens to provide a collimated path for the variable anamorphic system.

Two types of variable anamorphic systems will be considered. The first is the zoom system made up of cylindrical lenses. A system of this type has been designed, built, and shown to perform satisfactorily. It proved, in manufacture, to be rather difficult to align. A second type of system makes use of a series of tilting prisms. A system of this type has been built and is in process of manufacture. It is expected that this will be easier to assemble than the cylindrical system but confirmation of this must await assembly of the unit within the next few weeks. The type of system to be used in the present development will be based on ease of manufacture and assembly since final production cost is as much a criterion of success as satisfactory optical performance. Since the prism type system has yet to be assembled the choice cannot be made at the present time. For purposes of illustration, the cylindrical system is assumed, but this should not be interpreted as indicating a preference. The choice will be based on the economic factors noted above.

The anamorphic zoom system will be followed by a positive objective lens which will form a real image to be viewed with the Wild compensating eyepiece. Since a negative collimating lens is used, the image formed by the system will be erect. The collimator and anamorphic zoom portion of the system will essentially fit into the space presently taken up by the eyepiece tube. Thus, the three inch increase in eyepoint can be reserved for the objective lens focal length. Indications are that this focal length will not have to be this long, and thus the eyepoint requirement can be met. Figure 3-1 shows the present concept of the optical configuration. Maintenance of existing performance is assured by the fact that a similar system was previously designed that was diffraction limited throughout its range. It is to be noted that the anamorphic zoom range of that system was larger than the 2.2 to 1 range of this system.

The final package will be an assembly that will screw onto the High Power Stereoviewer in place of the existing eyepiece tube. Removal of the eyepiece tube and attachment of the anamorphic system will require only a jewelers screwdriver to loosen and tighten appropriate set screws.

4.0 PROPOSED PROGRAM

The program for development of the anamorphic system for the High Power Stereoviewer will consist of two phases. Phase I will be a three months design program. During this program the optical and mechanical design of the system will be completed. The conclusion of this program will be a report describing in detail the system to be built during Phase II.

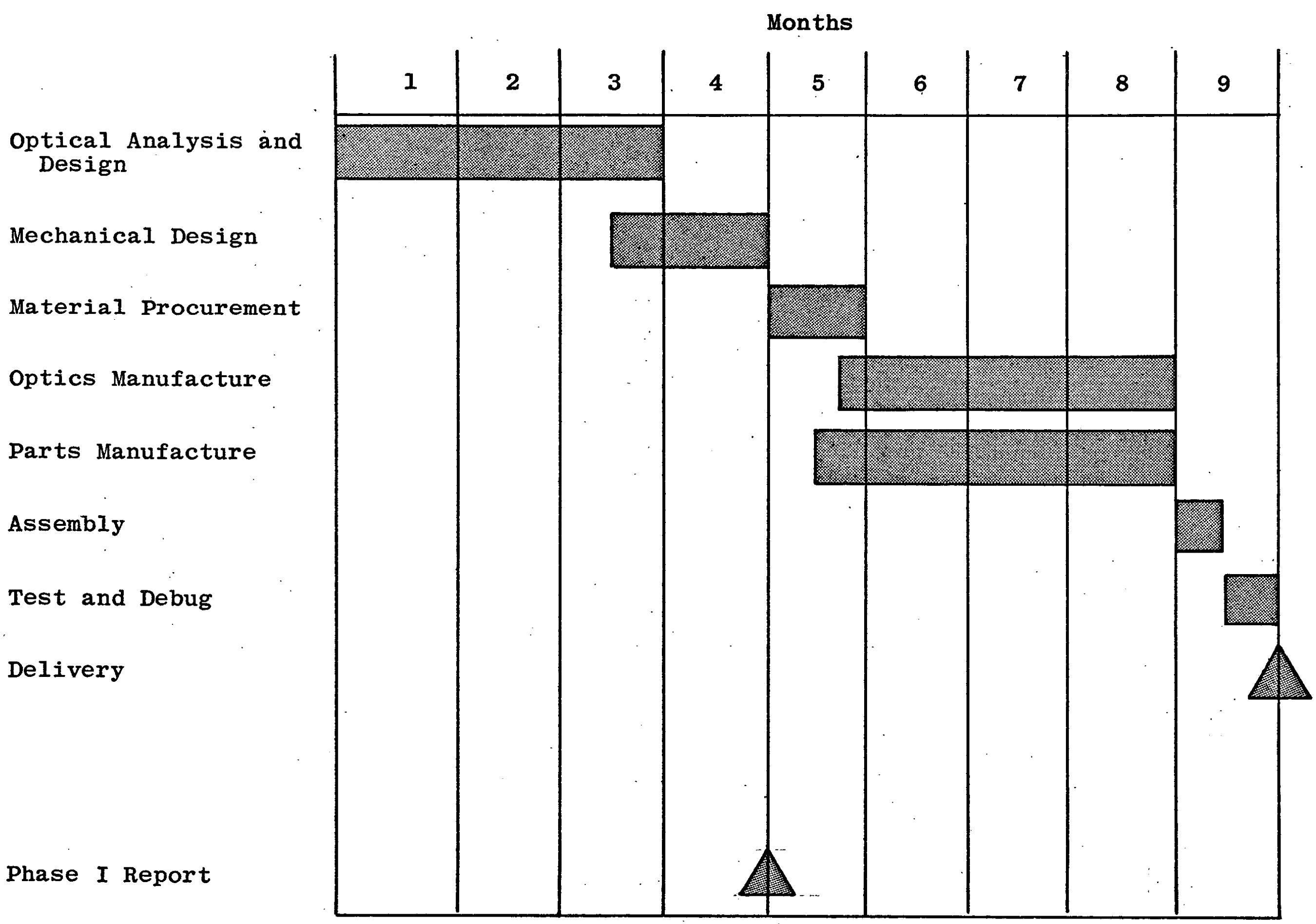

Figure 4-1 Program Schedule

It is presently anticipated that the Phase II manufacturing will await approval of the Phase I final report. If desired, the manufacturing cycle can follow the design effort directly.

The manufacturing cycle will require six months for completion. Thus, a total of nine months plus any time for Phase I approval is the expected completion time. Figure 4-1 shows the anticipated delivery schedule.

4.1 PROGRAM MANAGEMENT

This program will be under the direction of the Optical Systems Department. The relationship of this department to the whole [redacted] Research and Development organization is shown in Figure 4-2. This department will be responsible not only for the concept and design of the system, but will also be responsible for the satisfactory performance of the completed unit. Thus, at the assembly stage, the designer, who clearly understands best the optical requirements of the system, will be available for consultation. His responsibility will not end until the system is performing the way it was designed. This assures compliance of the final unit with the performance predictions given in the Phase I final report.

To assure expeditious completion of the project, a program manager will be selected from the Optical Systems Department. He will have the responsibility and the authority for the successful completion of the program. Figure 4-3 shows the program organization with names of personnel tentatively selected for key responsibilities. These selections are subject to the work load existing at the time the contract is signed. Resumes are included in the back of this proposal.

25X1

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4.2 WORK STATEMENT

Upon receipt of a duly executed contract, [redacted] 25X1
25X1 [redacted] will, in a two phase program, design and manufacture a variable anamorphic system for use with the High Power Stereoviewer.

The requirements for this system will be as follows:

1. Anamorphic range 2.2 to 1.
2. Field loss shall not exceed 5% of that of the normal High Power Stereoviewer.
3. The anamorphic axis shall be rotatable through 360°.
4. The eyepoint, when using the anamorphic system, shall not be raised more than three inches above that of the normal instrument.
5. Assembly or disassembly of the anamorphic system will require no special tools and will require no more than five minutes. It will fit any High Power Stereoviewer.
6. Design and fabrication drawings will be furnished.
7. A comprehensive operator's manual will be provided.
8. The anamorphic system will not significantly degrade the optical performance of the High Power Stereoviewer when used with [redacted] objective lenses 25X1
   and compensating eyepieces.

We see no reason why these requirements cannot be met, and this conclusion will be verified during the Phase I design effort. Any limitations that may appear during this effort will be described in the report to be submitted at the end of the Phase I portion of the program.

After approval of the design one pair of anamorphic systems will be manufactured, tested, and delivered.

5.0 CAPABILITY

The design and fabrication of a variable anamorphic system for the High Power Stereoviewer will be an extension of previous and existing programs at [redacted] A 25X1 variable anamorphic eyepiece was designed and built for use with the Zoom 70 Stereoscope. That instrument was too long and too heavy, for satisfactory operational use. In addition, it produced an unacceptable inversion of the image. As a result of this development a second program was established.

In this program a three months study of various methods of producing variable anamorphism was conducted. This program had as its objective, a system for use with the Zoom 70 Stereoscope. However, most of the conclusions reached are applicable to any variable anamorphic system. This experience will be directly applicable to the present program.

The High Power Stereoviewer itself was, of course, developed at [redacted] The improved performance obtained with the [redacted] objectives proves the excellence of the instrument design and manufacture. That is to say that the basic instrument plus the modifications necessary to make the stereoviewer are of such an excellent design that performance is limited only by the objective lens. This design capability will assure the required performance of the proposed system.

The Dual Viewing Microstereoscope is another recently developed instrument establishing our capability to design and manufacture high performance optical system. This device allows two operators to simultaneously view the same stereo pair. The optical system necessary to assure correct orientation of view in both positions is quite complex. Despite this complexity the performance of the instrument is comparable to that of a high quality stereoviewer. These same skills and capabilities will be applied to the present program.

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FINAL REPORT

DESIGN ANALYSIS

FOR

ANAMORPHIC SYSTEM FOR HIGH POWER STEREOVIEWER

Prepared by

[redacted] 25X1

May 19, 1967

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FINAL REPORT

DESIGN ANALYSIS

FOR

ANAMORPHIC SYSTEM FOR HIGH POWER STEREOVIEWER

ABSTRACT

The design Analysis phase of the contract for the Anamorphic System for the High Power Stereoviewer is completed and is presented in this Final Report

The design layout of the system is included and is described in detail.

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1.0 Introduction

2.0 Optical System

3.0 Mechanical System

- 3.1 Anamorphic Attachment - Design Layout
- 3.2 Controls
- 3.3 Attachment to High Power Stereoviewer

4.0 Summary

5.0 Contract Status

LIST OF ILLUSTRATIONS

Figure	
2-1	Optical Schematic of Anamorphic Attachment
3-1	Prism-Bracket Design Layout
3-2	Anamorphic Attachment Design Layout

1.0 Introduction

This Final Report summarizes the work effort of the Design Analysis phase of the contract for the Anamorphic System for the High Power Stereoviewer. The work effort covers the period 27 January 1967 to 12 May 1967.

2.0 Optical System

The optical system for the anamorphic attachment for the High Power Stereo Viewer consists of an anamorphic prism zoom system and its associated spherical optics as shown in Figure 2-1. The figure is approximately 4x scale. The negative collimator doublet receives the light from the final relay of the High Power Stereo Viewer and renders it parallel. The variable prism anamorphic system, which requires collimated light, follows this doublet. This system consisting of four doublet prisms acts as a variable afocal anamorphic telescope. It provides continuously variable magnifications from 1.0 to 2.2x by rotation of the prism elements. The decollimator doublet lens which follows the zoom system forms the final image at the eyepiece focal plane. The field lens is used to prevent eyepiece vignetting while still permitting the system to be very compact.

The system replaces the final upper field lens assembly of the High Power Stereo viewer which is easily removed. The overall length of the system, from the existing relay lens of the Stereo Viewer to the eyepiece image plane, is nominally 108.5mm. This corresponds to an eyepoint increase over the normal Stereo Viewer of approximately 22mm. The system accepts the 6x and 10x Wild eyepieces as well as the [redacted] 10x wide field eyepieces. 25X1
Eye relief with these eyepieces is identical to that

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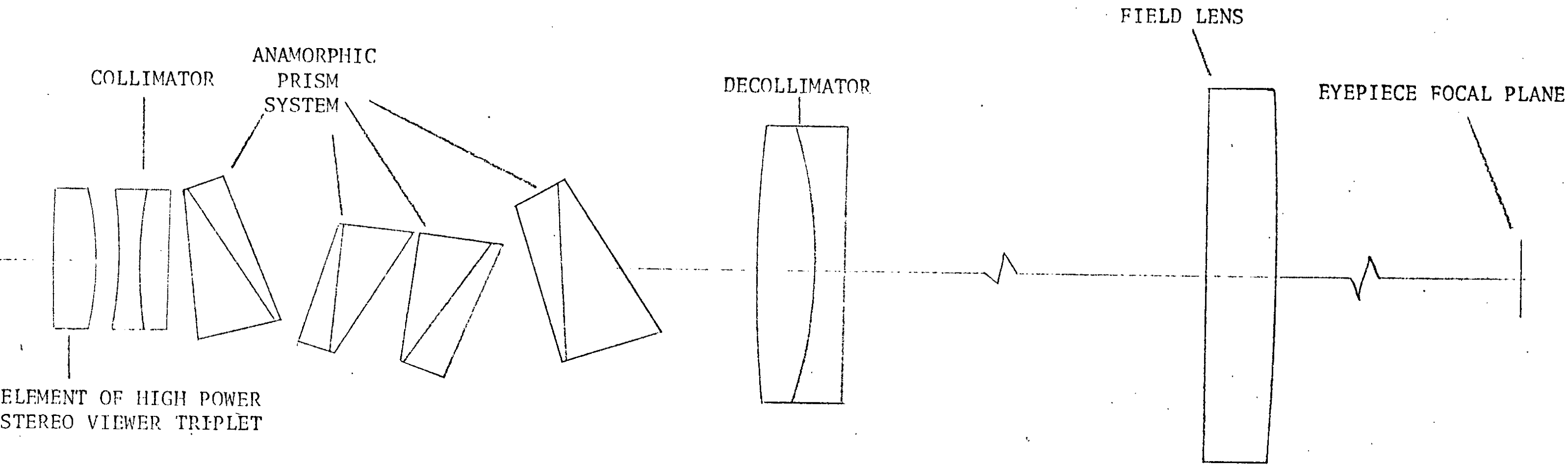


FIGURE 2 - OPTICAL SCHEMATIC OF HIGH POWER STEREOVIEWER ANAMORPHIC ATTACHMENT

when used on the High Power Stereo Viewer alone.

Adequate space is provided below the eyepiece image plane to assure accomodation of the longer [redacted] eyepieces. 25X1

Optical performance of the anamorphic attachment is essentially diffraction limited and does not reduce the overall performance of the High Power Stereo-Viewer

25X1 with or without [redacted] eyepieces and objectives. The relative insensitivity of the system to manufacturing variations assures that this performance will be achieved. There is no field reduction by the anamorphic attachment and the full useful field of the eyepiece is maintained throughout the zoom range of the High Power Stereo Viewer and the anamorphic attachment. The combination of the negative collimator and positive decollimator results in a complete cancellation of field curvature. The use of a slightly weaker field lens in place of the one in the High Power Stereo Viewer results in an overall flatter field for the system.

3.0 Mechanical System

Figures 3-1 and 3-2 found in the packet are mechanical design layouts of the prism bracket assemblies and anamorphic attachment respectively. These two drawings will be described in detail in section 3.1.

Section 3.2 describes the controls of the anamorphic attachment and Section 3.3 describes the method of attaching the anamorphic system to the High Power Stereoviewer.

3.1 Anamorphic Attachment Design Layouts

Figures 3-1 and 3-2, found in the packet at the end of this report, illustrate the prism-bracket assemblies and the design layout of the anamorphic attachment. The following paragraphs describe the parts called out on the two drawings. The description takes the parts as they would come in a mechanical assembly procedure.

The four prisms will be cemented to their respective brackets to obtain prism-bracket assemblies (1), (2), (3), and (4). These four assemblies will be positioned on their respective pivot points A, C, E and G., using pins set in an assembly fixture. Links (5), (6) and (7) will be attached to the pins of their respective brackets. The prisms, brackets and links become sub-assembly (19) which is inserted between the extensions of (21). Two pins each of (8) for pivot A, (9) for pivot C, (10) for pivot E., and (11) for pivot G are inserted through the extensions of (21) into the respective prism-bracket assemblies (1), (2), (3), and (4). This arrangement becomes sub-assembly (20) which will be tested for anamorphic magnification at this stage of assembly.

(22) is slipped over (21) and bar assembly (25) is positioned so that the slot accepts pin (18). Sleeve (26) is slipped over (21) and (22) and these three parts are drilled and tapped to accept screw (28). (30) and (31) are screwed together, thereby capturing key (32) and thurst washers (33), (34), (35) and (36) as shown on each side of the flange of (22). The assembly is checked for proper running clearance.

The threads mating (30) and (31) are cemented. (30) and (31) are then drilled and tapped together to accept screw (54). (37) is screwed to (31). (38) is inserted between (22) and (31) with the slot in (38) accepting key (32). (39) is screwed to (22) to secure (38). Two thrust washers (40) and spacer (41) are positioned as illustrated, in (38). (42) is slipped over (22) and rotated so that the open ended cylindrical slot in (42) engages pin (24) of assembly (25). Two thrust washers (40) and spacer (41) are positioned as illustrated against the face of (42). (43) is screwed into (38).

Segment (44) is positioned inside (42) so that the open portion of (44) straddles the end of assembly (25).

The ends of the segment will be used as positive stops to prevent the bar assembly (25) from exceeding the anamorphic magnification range. Over travel of the magnification range must be prevented as it will cause the prisms to contact. The segment will be properly positioned and held in place with screw (45).

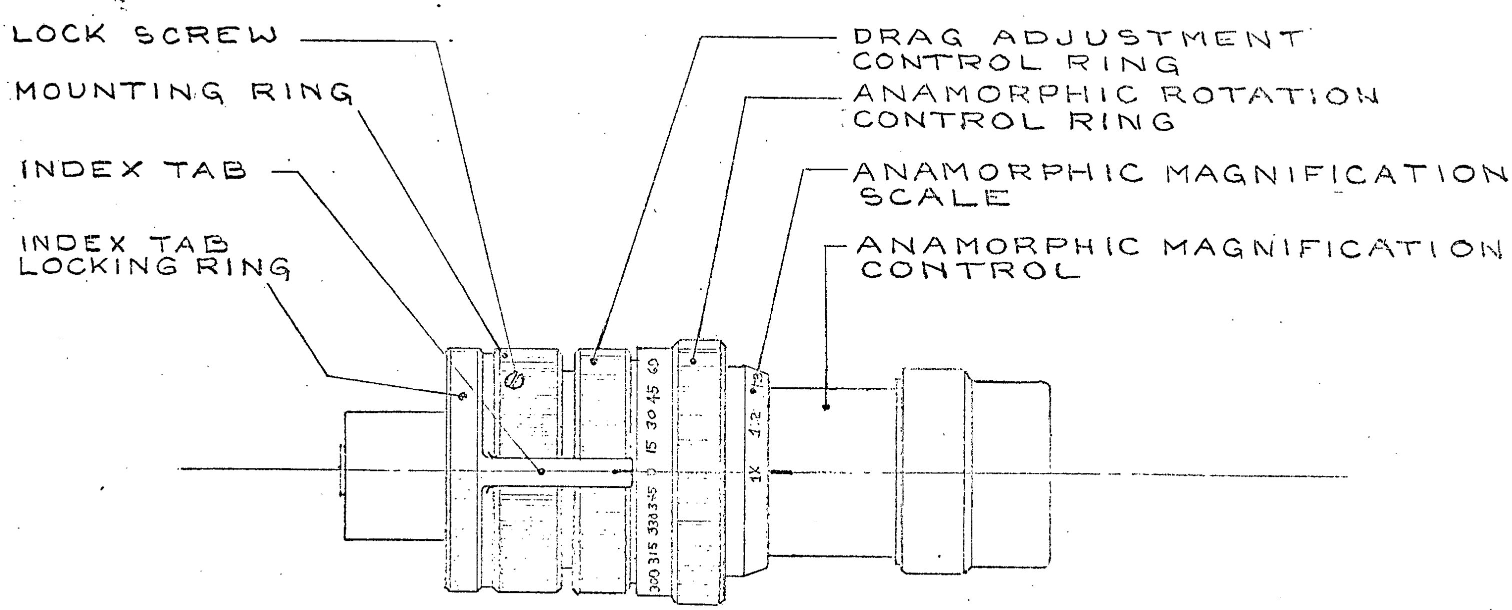
Lens assembly CD, the decollimator, is secured by retainer (29). (46) is positioned against (44). Sub-assembly (49) consisting of parts (47) and Lens E is screwed in place. (53) is slipped on (42) and (50) is screwed to (42). Index tab (51) may be located in any position with respect to (38) and secured by (52). The AB lens assembly is cemented in place. Lock screw (54) is inserted in (31).

3.2 Controls

The controls of the Anamorphic Attachment are illustrated in Figure 3-3. They are:

Anamorphic Magnification Control - Rotation of this control varies the anamorphic magnification. An index line on this control surface indicates the value of the anamorphic magnification.

Anamorphic Magnification Scale- The values of anamorphic magnification are engraved on the scale. The magnification values are given from 1.0x to 2.2x. Two sets of numbers will be engraved starting 180^{o} from one another in order to insure that at least one of the sets is visible after attachment of the anamorphic system to the High



CONTROLS OF ANAMORPHIC ATTACHMENT

FIG 3-3

Drag adjusting Ring - This control adjusts the tension on the anamorphic rotation ring. It can be positioned to lock the rotation ring.

Anamorphic Rotation Ring - Rotation of this control rotates the plane of anamorphism there-by allowing anamorphic correction to be introduced at any angle from 0^{o} to 360^{o}.

Index Tab - This tab may be positioned to indicate a reference position from which the rotation of the anamorphic prism cluster may be measured .

3.3 Attachment to High Power Stereoviewer

The upper field lens assembly of the High Power Stereoviewer is detached by unscrewing the upper half of the eyepiece tube. The anamorphic attachment is then screwed into place on the threads used by the eyepiece tube.

4.0 Summary

The design effort is completed and is described in this Final Report. The anamorphic prism zoom system used in the advanced anamorphic eyepiece for the Zoom 70 is used in this system. The mechanical means for tilting the prism required a new design because of the space limitations in the High Power Stereoviewer. The system as desiged is compact, easily attached and fulfills the design objectives of the proposal.

5.0 Contract Status

This Final Report describes the design analysis of Phase I of the contract. Is is now submitted for evaluation and approval. Upon receipt of approval Phase II will commence.

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